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Dietary Diversity on the Swahili Coast: The Fauna from Two Zanzibar Trading Locales

M. E. PRENDERGAST,[a]* E. M. QUINTANA MORALES,[b] A. CROWTHER,[c] M. C. HORTON[d] AND N. L. BOIVIN[e]

[a] *Radcliffe Institute for Advanced Study, Harvard University, Cambridge, MA 02138, USA*
[b] *Department of Anthropology, Rice University, Houston, TX 77005, USA*
[c] *School of Social Science, The University of Queensland, Brisbane, Queensland 4072, Australia*
[d] *Department of Archaeology and Anthropology, University of Bristol, Bristol BS8 1UU, UK*
[e] *Max Planck Institute for the Science of Human History, 07745 Jena, Germany*

ABSTRACT Occupants of coastal and island eastern Africa—now known as the 'Swahili coast'—were involved in long-distance trade with the Indian Ocean world during the later first millennium CE. Such exchanges may be traced via the appearance of non-native animals in the archaeofaunal record; additionally, this record reveals daily culinary practises of the members of trading communities and can thus shed light on subsistence technologies and social organisation. Yet despite the potential contributions of faunal data to Swahili coast archaeology, few detailed zooarchaeological studies have been conducted. Here, we present an analysis of faunal remains from new excavations at two coastal Zanzibar trading locales: the small settlement of Fukuchani in the north-west and the larger town of Unguja Ukuu in the south-west. The occurrences of non-native fauna at these sites—Asian black rat (*Rattus rattus*) and domestic chicken (*Gallus gallus*), as well as domestic cat (*Felis catus*)—are among the earliest in eastern Africa. The sites contrast with one another in their emphases on wild and domestic fauna: Fukuchani's inhabitants were economically and socially engaged with the wild terrestrial realm, evidenced not only through diet but also through the burial of a cache of wild bovid metatarsals. In contrast, the town of Unguja Ukuu had a domestic economy reliant on caprine herding, alongside more limited chicken keeping, although hunting or trapping of wild fauna also played an important role. Occupants of both sites were focused on a diversity of near-shore marine resources, with little or no evidence for the kind of venturing into deeper waters that would have required investment in new technologies. Comparisons with contemporaneous sites suggest that some of the patterns at Fukuchani and Unguja Ukuu are not replicated elsewhere. This diversity in early Swahili coast foodways is essential to discussions of the agents engaged in long-distance maritime trade. © 2017 The Authors International Journal of Osteoarchaeology Published by John Wiley & Sons Ltd.

Key words: East Africa; fishing; herding; hunter gatherers; introduced species; zooarchaeology

Introduction

In the mid-first millennium CE, the Swahili coast—an area stretching from southern Somalia to Mozambique, and including offshore islands, the Comoros and north-western Madagascar—became increasingly populated. In coastal and island Kenya and Tanzania (Figure 1), villages and towns emerged out of earlier Iron Age farming societies and developed ties with the broader Indian Ocean interaction sphere through trading links that stretched as far as the Arabian Peninsula, the Indian subcontinent and ultimately south-eastern Asia. By the second millennium CE, a cosmopolitan maritime society had emerged, engaged with the sea and the world beyond eastern Africa, but with origins on the mainland (Fleisher *et al.*, 2015). While second millennium CE 'stone towns' are better known, settlements dating to the Middle Iron Age (MIA; c. 6th–10th centuries CE) are key to the development of maritime trade and Swahili society.

Zooarchaeological data are particularly critical to this endeavour for two reasons. First, faunal remains can help pinpoint the timing and nature of early trade, by tracing Asian taxa that were eventually introduced to eastern Africa, such as zebu cattle (*Bos indicus*), domestic chicken (*Gallus gallus*), black rat (*Rattus rattus*) and house mouse (*Mus musculus*) (Boivin *et al.*, 2013). Second, a deeper understanding of subsistence strategies helps us envision more accurately the agents of this trade. While elsewhere in the Indian Ocean interaction sphere, trading locales were often large,

* Correspondence to: M. E. Prendergast, Radcliffe Institute for Advanced Study, Harvard University, Cambridge, MA 02138, USA.
e-mail: mprendergast@post.harvard.edu

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Figure 1. (a) Map of the part of the Swahili coast located in Kenya and Tanzania and (b) detail of Zanzibar (Unguja) Island, showing sites discussed in the text. The site of Chibuene, in central coastal Mozambique, is not shown. [Colour figure can be viewed at wileyonlinelibrary.com]

permanent settlements reliant on food production (Seland, 2014), there is more diversity in early Swahili coast subsistence strategies, as we demonstrate here.

Although some in-depth zooarchaeological analyses have been conducted at Swahili sites—notably in the Lamu and Zanzibar archipelagos (Horton, 1996; Horton, in press), and as part of more recent studies of fishing practises on the eastern African coast (Quintana Morales, 2013)—the more common pattern is a taxonomic list appended to a site report. Fish, central to coastal economies, frequently go understudied. Collection practises vary widely, with earlier projects rarely reporting smaller fish or micromammals. In this paper, we present zooarchaeological data from two trading locales on the main island of the Zanzibar archipelago, where recent re-excavation campaigns

prioritised microfaunal recovery and chronological resolution. We discuss assemblage taphonomy, taxonomic diversity and inferences that may be made about fishing and foraging strategies. We contextualise these findings within a broader discussion of early Swahili coast terrestrial and marine foodways.

Background to the study area

The Zanzibar archipelago has a tropical climate shaped by the intertropical convergence zone and the Indian Ocean Dipole (Marchant *et al.*, 2007). These forces result in a long rainy season (*masika*) from March to May and a short rainy season (*vuli*) from October to December; mean annual rainfall is 1500–1800 mm per year (Punwong *et al.*, 2013). Vegetation is a mix of dry and moist forests, shrubland and grassland (Burgess & Clarke, 2000). Today on the main island (Unguja; here referred to as Zanzibar Island), the landscape has been transformed by tourism and the cultivation of cash crops and other recent imports such as maize. The premodern economy, however, rested on African crops like sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*) and cowpea (*Vigna unguiculata*) (Crowther *et al.*, 2016b), with introduced Asian crops such as rice (*Oryza sativa*) becoming increasingly important in the second millennium CE (Walshaw, 2010). While the island's soils, overlying coral rag, can be thin and poor, there are deep, fertile soils on the western side of the island, where Iron Age settlement took place. Planting of sorghum and millet typically occurs during both short and (to a lesser extent) long rains, while rice, a riskier crop, grows only during the long rains and is highly vulnerable to the timing and nature of these rains (Tanzania, 2016; Walshaw, 2010).

Animal husbandry in Zanzibar today relies on three domesticates: cattle (*Bos* sp.), goat (*Capra hircus*) and chickens (Tanzania, 2016). Taurine cattle (*Bos taurus*) and goat had long been present on the African mainland prior to Iron Age occupation of Zanzibar, while chicken and later zebu cattle or indicine–taurine crossbreeds were introduced via maritime exchanges (Boivin *et al.*, 2014; Crowther *et al.*, in press). The earliest evidence for zebu in Zanzibar is found at Kizimkazi in the mid-second millennium CE (Van Neer, 2001). The history of sheep (*Ovis aries*) on the island is little known, but it remains a minor component of the economy today, and its consumption is reserved for special occasions.

Zanzibar's richest resources, however, lie under water, in mangrove creeks, coral reefs and seagrass beds. On the western side of the island, the reefs are particularly extensive and are easily accessible in the shallow, calm sea. Fishing takes place year-round, although fishing activities are reduced during the strong winds of the south-east monsoon (*kusi*) from April to September. The primarily small-scale artisanal fishery consists of various traps, nets and hook and line techniques used in nearshore, shallow waters; technology remains largely traditional, involving nonmotorised dhows, small boats and canoes (Jiddawi & Öhman, 2002). Most families combine fishing and farming for household subsistence.

Study sites

In 2011 and 2012, the Sealinks Project undertook excavations at two Zanzibar Island sites with evidence for early trade, as part of a broader investigation of the development of maritime societies in eastern Africa and their connections with the Indian Ocean world (e.g., Crowther *et al.*, 2016a; Crowther *et al.*, 2016b; Crowther *et al.*, in press). Fukuchani (S5°49′18″, E39°17′27″) lies on the north-western coast on a long beach, protected by Tumbatu Island. The site is comprised of at least 10 mounded middens running parallel to the coastline. Since test excavations in 1989 and 1991 (Horton, in press), much of the site has been disturbed. New excavations targeted intact deposits, aiming to improve chronological resolution and recover high-quality botanical and faunal samples. The 2011 campaign revealed remains of a daub structure, local Tana tradition/triangular incised ware (TT/TIW) ceramics, trade wares originating in the Near East, glass and shell beads and abundant bone and shell. Palaeobotanical analyses indicate the presence of sorghum, pearl millet and baobab (*Adansonia digitata*) (Crowther *et al.*, 2016b). Three Accelerator Mass Spectrometry (AMS) radiocarbon dates on charcoal and bone place this occupation in the seventh to eighth centuries CE.

The larger (c. 17 ha) site of Unguja Ukuu (S6°18′0″, E39°29′0″) sits on the south-western coast, on a coral rag peninsula stretching between the mangrove-lined Uzi Channel and the resource-rich Menai Bay. This natural harbour location contributed to Unguja Ukuu's growth as a trading port. Excavations in 1984 (Horton, in press) and 1989–1993 (Juma, 2004) revealed a wattle-and-daub settlement, with deep midden deposits containing TT/TIW pottery as well as Near Eastern and Chinese trade wares, iron slag, glass and shell beads and bead grinders and rich faunal and shell assemblages. The 2011–2012 excavations at Unguja Ukuu sought to improve chronology and faunal and botanical recovery, within the few areas remaining undisturbed and

accessible. Artefacts were broadly similar to those of earlier campaigns and included trade goods such as local incense and imported glass beads (Crowther *et al.*, 2015; Wood *et al.*, 2016). Sorghum, pearl millet and baobab were identified among the botanical remains, in addition to small quantities of rice (Crowther *et al.*, 2016b). A Bayesian analysis of 31 AMS radiocarbon dated samples—25 crop seeds, 3 black rat bones and 3 samples of mangrove charcoal—places the main occupation in the 7th–10th centuries CE (Crowther *et al.*, 2016b).

Materials and methods

Three trenches (FK10–FK12; 7 m^2) were excavated at Fukuchani and six (UU10–UU15; 25 m^2) at Unguja Ukuu, using the single-context method. All sediments were sieved, either via dry sieving (3-mm mesh) during excavation or via flotation (0.3-mm mesh) and wet sieving (1-mm mesh) of sediment samples from each context. Faunal remains were collected at every stage of this process: by hand during excavation and from both dry-sieved and wet-sieved sediments. At both sites, nearly all faunal remains came from midden contexts. At Fukuchani, a house structure was identified, but no fauna was associated with its floor. At Unguja Ukuu, two intact hearths and three disintegrated hearths were excavated; faunal remains were absent except in two of the disintegrated hearths. All faunal remains from both sites (except minor amounts found in the paleobotanical flots) were fully analysed, with the exception of one trench at Unguja Ukuu (UU14), in which all tetrapods were analysed, but fish remains were analysed in 25% of bone-bearing contexts. Mollusc shells from both sites will be reported elsewhere (Faulkner *et al.*, unpublished data).

Faunal analyses took place using the collections of the National Museums of Kenya (Nairobi) and Muséum national d'Histoire naturelle (Paris). Guides were occasionally used (Fischer & Bianchi, 1984; Froese & Pauly, 2012; Smith *et al.*, 1986; Walker, 1985), including for distinguishing between caprines (Zeder & Lapham, 2010) and among several gallinaceous birds (MacDonald, 1992). Given the difficulties of distinguishing indicine, taurine and crossbred cattle remains (Magnavita, 2006), here we identify them as *Bos* sp. Elsewhere, we discuss the methods and findings of ancient DNA (aDNA) analysis and zooarchaeology by mass spectrometry (ZooMS) collagen fingerprinting, used to confirm or negate attributions to domestic chicken or black rat (Prendergast *et al.*, unpublished data).

For tetrapod remains, the number of identified specimens (NISP) includes specimens that could be identified minimally to element or element group (e.g. limb bone) and to taxon, taxonomic group or size class (Table S1); unidentified fauna (NID) were weighed. Each identified specimen was examined with a 20× lens to identify cut, percussion, abrasion, carnivore and rodent marks and biochemical pitting; burning was also noted. Weathering was scored following Behrensmeyer (1978), and cortical preservation was given an overall rating (good, moderate, poor). Estimates of minimum number of individuals (MNI) were calculated using laterality, size and, where relevant, age. MNI was calculated for all contexts jointly at Fukuchani, while at Unguja Ukuu, MNI was calculated first for all contexts and again separately for two occupational phases distinguishable only in trenches UU11 and UU14.

Fish nomenclature follows Eschmeyer (2014). All elements were considered for identification, and taxonomic attributions were based on the morphological features of each fragment and not through association with other identified specimens. MNI was calculated per context taking into account laterality and size. For Chondrichthyes, MNI was calculated from the presence of at least one vertebra type in each context and not by size, as for bony fishes, because the size of cartilaginous fish vertebrae varies within the individual. The total length (TL) of live individuals was estimated by comparing archaeological bones with similarly sized reference specimens of known lengths. Burning of fish remains was noted based on black, grey and white discolouration, and other modifications such as gnawing and cut marks were recorded if visible to the naked eye.

Results

Assemblage preservation and taphonomy

Preservation at both sites is excellent, with most cortical surfaces intact and visible. This led to high identification rates (Table 1): At Fukuchani, 56% of fish remains and 73% of tetrapod remains (by weight) were identified to taxon, while at Unguja Ukuu, 53% of fish remains and 66% of tetrapod remains were identified. At Unguja Ukuu, there was substantial intrasite variation in terms of fragmentation and thus identifiability: some contexts had abundant fragments of cancellous bone from large carcasses, likely marine tetrapods.

Bone surface modifications are few on tetrapod remains (Table 2, Figure 2), aside from cut marks, which appear on 8% of limb bone specimens. This low rate is unsurprising given that both sites' dominant taxa weigh

Table 1. Numbers of identified specimens and identification rates at the studied sites

Site	Trench	Fish NISP	Fish Total weight (g)	Fish %NID	Tetrapods NISP	Tetrapods Total weight (g)	Tetrapods %NID
Fukuchani	10	162	41	38%	111	127	20%
	11	95	94	65%	59	210	32%
	12	594	167	34%	335	384	27%
	Site total	851	302	44%	505	722	27%
Unguja Ukuu	10	165	99	33%	55	568	44%
	11	2622	1154	45%	335	1221	46%
	12	13	3	8%	14	16	54%
	13	29	26	65%	25	208	37%
	14	5241[a]	3111[a]	49%	1077	3774	25%
	15	733	227	39%	83	298	52%
	Site total	8803	4621	47%	1589	6085	33%

NISP, number of identified specimens; %NID, proportion of specimens that were not identified, based on weight.
[a]Sample of 13 out of 52 bone-bearing contexts: 1408G, 1412H, 1412I, 1417K, 1418, 1418L, 1420M, 1421, 1422, 1431, 1432, 1434, 1436.

under 10 kg; at Unguja Ukuu, larger carcasses—of cattle or marine turtle—are cutmarked at higher rates. Tooth marks and percussion marks are rare to absent. Traces of cutting and gnawing were visible on <1% of identified fish specimens at Unguja Ukuu and on none at Fukuchani. Burning affects 1–8% of fish NISP and 2–8% of tetrapod NISP at Unguja Ukuu; one burnt fish specimen was identified at Fukuchani.

The marine economy

Both sites' subsistence strategies focus on the marine environment, with abundant mollusc shells (Faulkner *et al.*, unpublished data), a predominance of fish and fewer marine mammal and turtle remains. At Fukuchani, fish comprise 63% of NISP and 92% of MNI. Although 20 families were identified, 68% of total NISP is made up of four generally associated with coral reefs: emperor fish (Lethrinidae), parrotfish (Scaridae), groupers (Serranidae) and surgeonfish (Acanthuridae) (Tables 3 and S2). Emperor fish and groupers are bottom-feeding, carnivorous fish, while parrotfish and surgeon fish are often found grazing on algae growing over coral substrates (Carpenter & Allen, 1989; Nelson, 1994). Other common families are also found in shallow coastal areas close to the sea bottom around coral reefs and estuaries, such as snappers (Lutjanidae) and grunts (Haemulidae), and along sandy-muddy bottoms, for example, bonefish (Albulidae) (Fischer & Bianchi, 1984). This pattern generally overlaps with findings from Horton's (in press) test excavations (Table S3), but that sample had a narrower taxonomic range and proportionally fewer fish (13% total NISP), possibly due to sampling

Table 2. Bone surface modifications at the studied sites

	Tetrapods, all bone, excluding teeth and horncore							Fish
	Cut marks		Other marks					
	All bone	Limbs	Percussion	Tooth pits	Rodent gnawing	Abrasion	Burning	Burning
Fukuchani trench								
10	5 (6%)	1 (2%)			1 (1%)			1 (0.6%)
11	1 (3%)	1 (3%)						
12	21 (7%)	19 (10%)		9 (3%)	3 (1%)	5 (2%)		
Total	27 (6%)	21 (8%)	0	9 (2%)	4 (1%)	5 (1%)	0	1 (0.1%)
Unguja Ukuu trench								
10	8 (21%)	7 (30%)				1 (3%)	3 (8%)	13 (7.9%)
11	12 (4%)	5 (4%)		2 (0.7%)	1 (0.4%)			35 (1.3%)
12	2 (17%)	2 (33%)						
13	6 (26%)	3 (25%)						1 (3.4%)
14	66 (7%)	39 (7%)	2 (0.2%)	3 (0.3%)	3 (0.3%)	12 (1%)	19 (2%)	58 (1.1%)
15	4 (5%)	4 (7%)					2 (3%)	7 (1.0%)
Total	98 (7%)	60 (8%)	2 (0.1%)	5 (0.4%)	4 (0.3%)	13 (1%)	24 (1.8%)	114 (1.3%)

All values expressed as NISP (%total NISP). 'Limbs' refers to the six long limb bones.

Figure 2. Cutmarked bones from Unguja Ukuu. Clockwise from top left: astragalus of a goat (*Capra hircus*), distal end of a limb bone (humerus?) of sea turtle (Cheloniidae), coracoid of a chicken (*Gallus gallus*), and carapace fragment of sea turtle with cut marks and possible spear hole. Scale bar = 1 cm in all cases. [Colour figure can be viewed at wileyonlinelibrary.com]

and/or recovery biases. Other marine fauna represented in our assemblage (Table 4) include dolphin (cf. *Tursiops truncatus*), possible dugong (*Dugong dugon*) and sea turtle (Cheloniidae). Cut marks on remains of the latter two taxa indicate exploitation.

At Unguja Ukuu, in the five fully analysed trenches, 87% of NISP are fish (Table 1); by contrast, Horton's (in press) excavations reported 60% of NISP as fish, and Juma (2004) reports the presence of four principal fish families and no quantitative data. The general pattern of coral and estuary habitat exploitation in Horton's report mirrors that of Fukuchani; however, this substantially larger assemblage includes 16 additional families (Tables 3 and S4). Five families

Table 3. Summary of identified fish remains at the studied sites

	Fukuchani 2011		Unguja Ukuu 2011/2012	
Taxon	NISP (%)	MNI (%)	NISP (%)	MNI (%)
Chondrichthyes (cartilaginous fish)			76 (0.86)	38 (1.41)
Osteichthyes				
Lethrinidae (emperors)	277 (32.55)	81 (24.47)	2959 (33.61)	542 (20.16)
Serranidae (groupers)	108 (12.69)	33 (9.97)	751 (8.53)	253 (9.41)
Carangidae (jacks)	19 (2.23)	11 (3.32)	725 (8.24)	252 (9.38)
Siganidae (rabbitfish)	11 (1.29)	4 (1.21)	694 (7.88)	165 (6.14)
Scaridae (parrotfish)	129 (15.16)	50 (15.11)	646 (7.34)	229 (8.52)
Lutjanidae (snappers)	55 (6.46)	28 (8.46)	484 (5.5)	198 (7.37)
Albulidae (bonefish)	48 (5.64)	17 (5.14)	458 (5.2)	132 (4.91)
Acanthuridae (surgeonfish)	68 (7.99)	24 (7.25)	438 (4.98)	184 (6.85)
Mugilidae (mullets)	9 (1.06)	6 (1.81)	399 (4.53)	127 (4.72)
Haemulidae (grunts)	44 (5.17)	22 (6.65)	340 (3.86)	127 (4.72)
Gerreidae (mojarras)	28 (3.29)	12 (3.63)	258 (2.93)	98 (3.65)
Sphyraenidae (barracudas)	3 (0.35)	3 (0.91)	88 (1)	52 (1.93)
Balistidae (triggerfish)	16 (1.88)	11 (3.32)	80 (0.91)	47 (1.75)
Sparidae (sea breams)	4 (0.47)	4 (1.21)	64 (0.73)	31 (1.15)
Mullidae (goatfish)	5 (0.59)	5 (1.51)	53 (0.6)	39 (1.45)
Labridae (wrasses)	11 (1.29)	9 (2.72)	44 (0.5)	33 (1.23)
Ariidae (sea catfish)			42 (0.48)	25 (0.93)
Belonidae (needlefish)	6 (0.71)	3 (0.91)	34 (0.39)	22 (0.82)
Ostraciidae (cowfish)			34 (0.39)	11 (0.41)
Hemiramphidae (halfbeaks)	1 (0.12)	1 (0.3)	28 (0.32)	12 (0.45)
Muraenidae (moray eels)			21 (0.24)	12 (0.45)
Chirocentridae (wolf herrings)			17 (0.19)	14 (0.52)
Ephippidae (spadefish)			16 (0.18)	12 (0.45)
Monodactylidae (moonyfish)			12 (0.14)	6 (0.22)
Diodontidae (porcupinefish)			6 (0.07)	1 (0.04)
Chanidae (milkfish)	5 (0.59)	4 (1.21)	6 (0.07)	3 (0.11)
Platycephalidae (flatheads)			6 (0.07)	5 (0.19)
Elopidae (ladyfish)	4 (0.47)	3 (0.91)	4 (0.05)	1 (0.04)
Chaetodontidae (butterflyfish)			4 (0.05)	4 (0.15)
Scombridae (mackerels)			4 (0.05)	3 (0.11)
Terapontidae (tigerperches)			3 (0.03)	2 (0.07)
Megalopidae (tarpons)			3 (0.03)	3 (0.11)
Pomacanthidae (angelfish)			2 (0.02)	2 (0.07)
Scianidae (croakers)			2 (0.02)	1 (0.04)
Holocentridae (squirrelfish)			1 (0.01)	1 (0.04)
cf. Kyphosidae (sea chubs)			1 (0.01)	1 (0.04)
Total	851	331	8803	2688

commonly found around coral reefs make up 66% of fish NISP: emperor fish, groupers, jacks (Carangidae), rabbitfish (Siganidae) and parrotfish. The latter two are primarily herbivorous fish found around shallow reefs (Smith *et al.*, 1986). The jacks in the assemblage, dominated by *Caranx* spp., are typically fast-swimming predators often found over reefs (Nelson, 1994). Other fast-swimming fish are represented by four bones attributed to the tuna family (Scombridae), of which one caudal vertebra belongs to little tuna (*Euthynnus affinis*) and one left maxilla is likely from little tuna or tuna (cf. *Thunnus* sp.) (Figure S1). Little tuna and three species of *Thunnus* are found along the Tanzanian coastline; little tuna is generally less than 100 cm in total length, whereas *Thunnus* spp. can reach over 200 cm (Collette & Nauen, 1983). Although scombrids are generally considered oceanic migratory fish, the specimens at Unguja Ukuu are individuals of less than 90 cm in length, more likely to be found closer to the coastline. Cartilaginous fish (Chondrichthyes) were identifiable by a small number of vertebrae (1% fish NISP); it was not possible with available reference specimens to determine the species. The stratigraphy of UU11 and UU14 enables a breakdown of this subassemblage into earlier (c. 650–800 CE) and later (c. 800–1050 CE) phases of occupation, pointing to shifts in marine exploitation (Figure 3, Table S5). After 800 CE, emperor fish become relatively more abundant and slightly smaller. A comparison of reconstructed fish lengths of *Lethrinus* spp. from earlier and later periods at Unguja Ukuu shows a higher concentration of smaller sized individuals and slightly shorter mean length in the later

Table 4. Identified tetrapod remains at the studied sites

Classification			Fukuchani 2011		Unguja Ukuu 2011/2012	
			NISP (%)	MNI (%)	NISP (%)	MNI (%)
Aves						
	Galliformes	*Gallus gallus* (domestic chicken)	1 (0.2)[a]	1 (3.4)[a]	1 (0.1)[a]	1 (1.4)[a]
		Galliformes, not *G. gallus*			1 (0.1)[a]	1 (1.4)[a]
		Galliformes indet.			19 (1.2)	3 (4.1)
		aff. Galliformes			10 (0.6)	—
	Indeterminate	Small bird			7 (0.4)	3 (4.1)
		Medium-sized bird	2 (0.4)	—	42 (2.6)	2 (2.7)
Mammalia						
	Cetacea	cf. *Tursiops truncatus* (common bottlenose dolphin)	12 (2.4)	1 (3.4)		
	Sirenia	*Dugong dugong* (dugong)			1 (0.1)	1 (1.4)
		Large animal aff. *Dugong dugon* (dugong)	1 (0.2)	1 (3.4)		
	Soricomorpha	*Crocidura* sp. (musk shrew)			1 (0.1)	1 (1.4)
	Chiroptera	Pteropodidae (fruit bat)			3 (0.2)	1 (1.4)
	Primata	*Homo sapiens* (human)			3 (0.2)	2 (2.7)
		Colobus sp. (colobus monkey)	2 (0.4)	1 (3.4)		
		Cercopithecinae (blue or vervet monkey)	7 (1.4)	1 (3.4)	4 (0.3)	1 (1.4)
		Galagoides zanzibaricus (Zanzibar galago)			1 (0.1)	1 (1.4)
		Small primate			2 (0.1)	—
	Carnivora	*Panthera pardus* (Zanzibar leopard)			1 (0.1)	1 (1.4)
		Felis catus (domestic cat)			120 (7.6)	4 (5.5)
		Small carnivore aff. *F. catus* (cat)			15 (0.9)	—
		Canis familiaris (domestic dog)			6 (0.4)	1 (1.4)
		Medium carnivore aff. *Canis familiaris* (domestic dog)			1 (0.1)	—
		Small carnivore cf. *Herpestes sanguineus* (slender mongoose)			6 (0.4)	1 (1.4)
		Small carnivore, aff. Herpestidae (mongoose)			1 (0.1)	—
		Small viverrid aff. *Genetta servalina* (servaline genet)	1 (0.2)	1 (3.4)		
		Small mustelid aff. *Ictonyx striatus* (zorilla)	2 (0.4)	1 (3.4)		
		Small carnivore indet.	2 (0.4)	—	3 (0.2)	—
	Hyracoidea	*Dendrohyrax validus* (tree hyrax)	57 (11.3)	5 (17.2)	26 (1.6)	3 (4.1)
	Artiodactyla	Suidae:				
		Potamochoerus larvatus (bushpig)	3 (0.6)	1 (3.4)	3 (0.2)	2 (2.7)
		Suid			1 (0.1)	—
		Bovidae:				
		Neotragus moschatus (suni)	12 (2.4)	2 (6.9)	5 (0.3)	2 (2.7)
		Bovid size 1 cf. *Neotragus moschatus* (suni)			4 (0.3)	1 (1.4)
		Philantomba monticola (blue duiker)	1 (0.2)	1 (3.4)	1 (0.1)	1 (1.4)
		Cephalophus adersi (Ader's duiker)	1 (0.2)	1 (3.4)	2 (0.1)	1 (1.4)
		Bovid size 1 cf. *Cephalophus adersi* (Ader's duiker)			3 (0.2)	1 (1.4)
		Cephalophus sp. (Ader's or blue duiker)	11 (2.2)	—	3 (0.2)	—
		Bovid size 1 (*Neotragus* or Cephalophus)	138 (27.3)	5 (17.2)	140 (8.8)	1 (1.4)
		Bovid size 1–2	3 (0.6)	—	11 (0.7)	—
		Capra hircus (goat)			21 (1.3)	3 (4.1)
		Caprine (*Ovis aries* or *Capra hircus*)	2 (0.4)	1 (3.4)	237 (14.9)	7 (9.6)
		Bovid size 2–3			4 (0.3)	—
		Bos taurus (cattle)	1 (0.2)	1 (3.4)	11 (0.7)	2 (2.7)
		Bovid size 3 cf. *B. taurus*			3 (0.2)	—
		Bovid			10 (0.6)	—
	Rodentia	*Cricetomys gambianus* (giant pouched rat)	6 (1.2)	3 (10.3)	4 (0.3)	2 (2.7)
		Small mammal aff. *C. gambianus*			1 (0.1)	—
		Medium–large rodent aff. *Thryonomys* (cane rat)			1 (0.1)	1 (1.4)
		Rattus rattus (black rat)	2 (0.4)[a]	1 (3.4)[a]	12 (0.8)[a]	4 (5.5)[a]
		Murid rodent cf. *Mastomys* (multimammate mouse)			33 (2.1)[a]	10 (13.7)[a]
		Murid rodent not matching *Rattus*, *Mastomys* or *Gerbilliscus*			4 (0.3)[a]	1 (1.4)[a]

(*Continues*)

Table 4. (Continued)

			Fukuchani 2011		Unguja Ukuu 2011/2012	
			NISP (%)	MNI (%)	NISP (%)	MNI (%)
		Muridae (rats, mice and gerbils)			8 (0.5)	2 (2.7)
	Macroscelidae	Elephant shrew (*Petrodomus* or *Rhynchocyon*)			1 (0.1)	1 (1.4)
	Indeterminate	Micromammal (murid rodent-sized)			3 (0.2)	—
		Mammal size 0.5 (hyrax-sized)			33 (2.1)	—
		Mammal size 0.5–1 (hyrax-to-duiker sized)	225 (44.6)	—	17 (1.1)	—
		Mammal size 1 (suni/duiker-sized)			157 (9.9)	—
		Mammal size 1–2 (duiker-to-caprine sized)	7 (1.4)	—	149 (9.4)	—
		Mammal size 2 (caprine-sized)	1 (0.2)	—	213 (13.4)	—
		Mammal size 2–3 (caprine-to-cow sized)			23 (1.4)	—
		Mammal size 3 (cow sized)			26 (1.6)	—
Reptilia						
	Testudines	Cheloniidae (sea turtle)	2 (0.4)	1 (3.4)	91 (5.7)	4 (5.5)
		aff. Cheloniidae (sea turtle)			14 (0.9)	—
	Indeterminate	Reptile indet.			2 (0.1)	—
Indeterminate						
		Small animal indet.	3 (0.6)	—	39 (2.5)	—
		Large (size 3) animal indet.			25 (1.6)	—
Total			505	29	1589	73

[a]Confirmed via aDNA (chicken, black rat) or ZooMS (black rat) analyses (Prendergast *et al.*, unpublished data).

period (Figure S2). The implications of these patterns for fishing strategies are discussed in the succeeding texts.

Sea turtle specimens are abundant at Unguja Ukuu (Table 4), and 21% of them are cutmarked (Table 2), three times the assemblage average; a single cutmarked dugong rib was also identified. The true abundance of sea turtle may be underestimated: While confidently identified and probable chelonian remains jointly form 7% of NISP, a large fraction of unidentified specimens are cancellous fragments similar to those of marine fauna. Recording protocols may therefore explain distinct sea turtle frequencies among campaigns (Table S6).

The hunting and trapping economy

At Fukuchani, hunter trappers focused on the island's small bovids – suni (*Neotragus moschatus*), blue duiker (*Philantomba monticola*) and Ader's duiker (*Cephalophus adersi*)—which form more than one third of the total assemblage and 68% of wild terrestrial NISP after excluding indeterminate specimens (Figure 4, Tables 4 and S7). Tree hyrax (*Dendrohyrax validus*) and less frequently giant pouched rat (*Cricetomys gambianus*) were also prey taxa, as attested by cut marks. Other taxa present in low quantities include bushpig (*Potamochoerus larvatus*) and monkeys (*Procolobus* and Cercopithecinae), as well as two or more small carnivores; it is not certain that all of these entered the assemblage as food. Finally, a remarkable find at Fukuchani is a cache of 13 dwarf bovid (likely suni) metatarsals, from at least seven individuals (Figure S3). Nearly all were complete, and only one bore a cut mark. This cache was recovered ca. 20–30 cm above a juvenile human burial, clearly placed within the grave fill.

At Unguja Ukuu, wild taxa are relatively less abundant than at Fukuchani, and the spectrum of hunted or trapped fauna is similar, with small bovids dominant (Figure 4, Tables 4 and S8). Additional prey taxa—confirmed as such by cut marks—indicate a forested environment: These include bushpig, giant pouched rat and tree hyrax. Other fauna present, which may not be related to human occupation, included small carnivores, leopard (*Panthera pardus*), dwarf galago or bushbaby (*Galagoides* cf. *zanzibaricus*), bats, shrews and native rodents.

Domestic and commensal animals

There are clear differences between the two sites in terms of the importance of domestic and commensal animals (Table 4). At Fukuchani, just two caprine teeth and one cow (*Bos* sp.) tooth were identified in the assemblage, in addition to a few nondiagnostic postcranial specimens that could be caprines, based on size; similar trends were observed in Mudida & Horton's (in press) assemblage (Table S6). We identified one possible chicken specimen, but the genetic match was imperfect ($p = 0.54$); two black rat bones, however, were confirmed via aDNA and ZooMS, attesting to the presence of Asian fauna (Prendergast *et al.*, unpublished data).

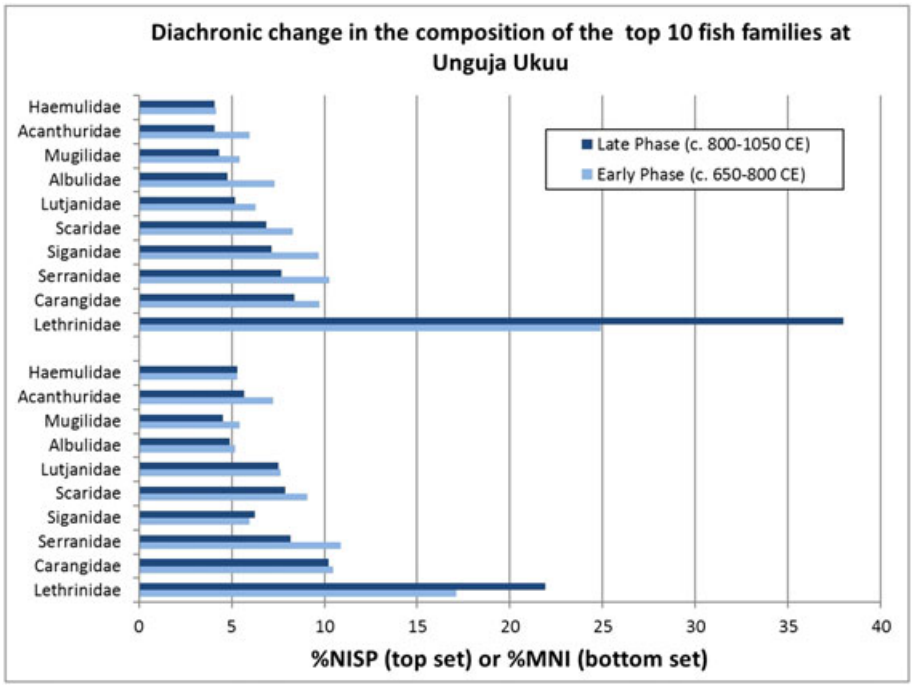

Figure 3. Relative taxonomic abundance of top 10 fish families in early and late phases, in units 11 and 14 only, at Unguja Ukuu. [Colour figure can be viewed at wileyonlinelibrary.com]

At Unguja Ukuu, caprines are central to the economy, forming 16% of total NISP and 95% of domestic food taxa. By contrast, cattle form 1% of total NISP or 3% of domestic food taxa. Of the 21 caprine remains enabling distinction, all were identified as goat, in agreement with earlier reports (Table S6). Chickens are also potentially common; however, this is stated cautiously as many remains were attributed to indeterminate Galliformes or Galliformes-sized birds. Of six tested specimens, just two produced readable aDNA sequences: one matched chicken and the other a different phasianid (Prendergast *et al.*, unpublished data). Six specimens (possibly seven) of domestic dog were identified, as well as more abundant remains of domestic cats, with 120 (possibly 135) specimens belonging to at least four individuals. Cats at Unguja Ukuu were likely attracted to murid rodents (NISP = 57), including Asian black rat and local gerbils and mice.

Shifts in domestic and commensal species are evident in a comparison of the early and late phases in UU11 and UU14 (Figure 5, Table S9). While the ratio of wild to domestic animals does not change substantially over time, the relative abundance of commensal animals increases. Rodent remains become much more abundant (by both NISP and MNI) in the post-800 CE phase, although cats are similarly abundant in both phases when using MNI. The increased rodent population might indicate an increase in human population density at Unguja Ukuu towards the end of the first millennium CE, as previously suggested by Juma (2004). This is further supported by evidence in the recent excavations for an increase in bone and mollusc shell density in the later phase of occupation (Crowther *et al.*, unpublished data). Among domestic food species, shifts are generally minor: Cattle and especially caprines become relatively less abundant in the later phase, while chickens become slightly more abundant. Pursuit of wild fauna continues to be an important part of the economy, although suni and duiker become slightly less important relative to other wild animals, such as marine turtles.

Discussion

Dietary diversity in Middle Iron Age farming communities

The faunal remains from Fukuchani and Unguja Ukuu demonstrate the occupants' ties to the Indian Ocean world but also speak to their diverse array of fishing, trapping and animal husbandry strategies. The occupants were farmers of mainly African crops (Crowther *et al.*, 2016b) and likely had their origins in mainland Bantu-speaking communities (Horton, in press). However, these farmers did not rely exclusively on domestic

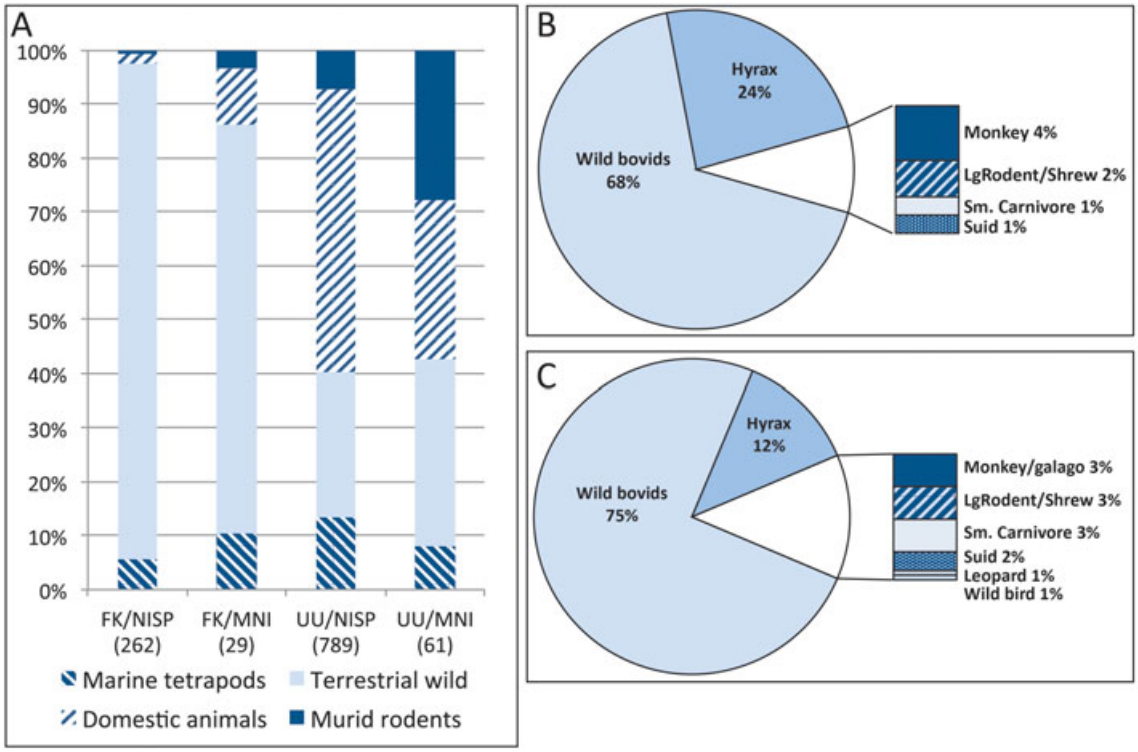

Figure 4. (A) Relative abundance, by NISP and MNI, of major taxonomic categories for tetrapod fauna at Fukuchani and Unguja Ukuu. Specimens not distinguishable as wild or domestic (e.g. 'Galliformes indet.') and mammal size classes are excluded, as are small fauna that likely formed part of the background (e.g. musk shrew, bat). (B) and (C) Terrestrial wild fauna (with same exclusions) at Fukuchani (B) and Unguja Ukuu (C), based on NISP. [Colour figure can be viewed at wileyonlinelibrary.com]

animals but rather preyed on Zanzibar's wide array of marine and terrestrial resources. Notably, there is nothing in the faunal record at Fukuchani or Unguja Ukuu to suggest adherence to Islamic dietary guidelines, nor are there major differences in terms of the chosen wild resources between these sites and two Zanzibar cave sites thought to be occupied by hunter gatherers (Chami, 2009; Prendergast *et al.*, 2016). This is interesting because there is material culture evidence at Unguja Ukuu—in the form of an incense burner—to suggest that this may have been an early site for the spread of Islam on Zanzibar (Crowther *et al.*, 2015). Evidence from other Zanzibar sites and from elsewhere along the Swahili coast suggests that Islam was well-established in the region by the late first millennium CE (Horton, 1996; Horton, in press). Yet exploitation of clearly *haram* animals—among them bushpig and sea turtle—is evident at multiple Swahili coast sites, well into the second millennium CE (Quintana Morales & Prendergast, in press), and continues today in some areas (Walsh, 2007).

The wild terrestrial fauna represented at both Fukuchani and Unguja Ukuu are largely forest-dwelling, although suni and blue duiker can also thrive on more open coral rag thickets. Both sites would likely have been within easy reach of woodlands, even though today there is comparatively little near Fukuchani. While bushpig may have been obtained on spear hunts (possibly with the assistance of dogs), most other fauna in both assemblages could be caught in traps, nets or snares made from perishable materials, possibly similar to those recorded ethnographically on Zanzibar (Walsh, 2007). Elsewhere, ethnographic accounts show that burrowers such as giant pouched rats can be hand-caught, an individual pursuit; net hunts for small bovids, by contrast, often involve family groups or whole communities (Lupo & Schmitt, 2002). The setting of traps or snares, left out for days at a time, requires communal trust and ownership of both technologies and territories. Thus, we suggest that resource procurement at Fukuchani and Unguja Ukuu may not have been the work of a small number of hunters but rather engaged numerous community members, even while some were devoted to farming, fishing, shellfish collection and—particularly at Unguja Ukuu—livestock herding and chicken keeping, the latter a village activity that, like trapping, is widely associated with women and children today.

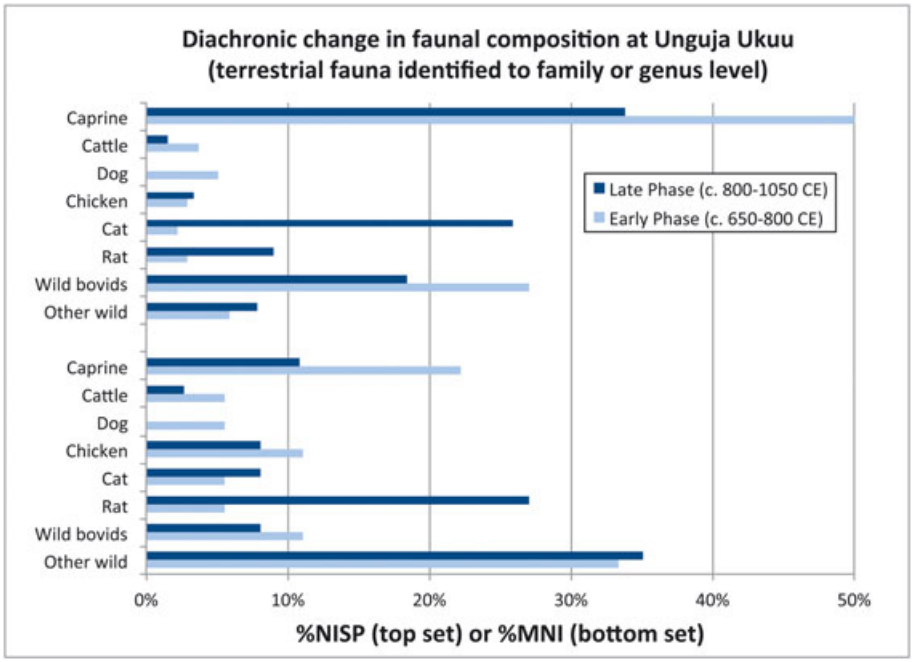

Figure 5. Relative taxonomic abundance for terrestrial tetrapod fauna in early and late phases, in units 11 and 14 only, at Unguja Ukuu. Specimens not distinguishable as wild or domestic (e.g. 'Galliformes indet.') and mammal size classes are excluded, as are small fauna that likely formed part of the background (e.g. musk shrew, bat). [Colour figure can be viewed at wileyonlinelibrary.com]

Such deep engagement with the forest may help explain the cache of 13 dwarf bovid metatarsals at Fukuchani. De Maret (2016) demonstrated that ethnographically, bovid metapodials are commonly used as children's dolls and fertility symbols in central Africa and in numerous other contexts. Archaeologically, he notes that metapodials are associated with juvenile and some adult burials dating to the 9th–13th centuries CE in south-eastern Congo. While we cannot know the Fukuchani cache's exact meaning, the finding demonstrates that wild bovids, which dominate the diet, also held social significance for the site's occupants.

Comparison with other Swahili coast sites (Figure 6) suggests that despite the contrasts between Unguja Ukuu and Fukuchani, they are seen to resemble one another in many respects once compared against a broader and highly diverse set of early Swahili coast sites. A principal component analysis was applied to Early Iron Age (EIA; n = 1) or MIA (n = 12) sites with published, quantitative faunal data. Four variables were examined (Table S10): the percentage of fish (using NISP) in the total vertebrate assemblage; the percentage of domestic taxa (using NISP) in the total tetrapod assemblage, excluding marine animals, microfauna and categories for which wild or domestic status could not be ascertained (e.g. Galliformes; Mammal Size 2); richness of the wild terrestrial faunal assemblage, expressed as the number of discrete taxa (NTAXA); and evenness of the wild terrestrial faunal assemblage, using the reciprocal of Simpson's dominance index ($1/D$).

Through this comparison, we observe that the patterns of faunal exploitation at Fukuchani and Unguja Ukuu—high frequencies of fish, low and moderate numbers of domesticates and a relatively narrow wild assemblage dominated by a handful of taxa (dwarf bovids and hyrax)—are similar to patterns observed at the EIA site of Juani School in the Mafia archipelago (Crowther *et al.*, 2016a) and the MIA mainland coastal site of Mpiji (Chami, 1994). A more extreme version—with strong dominance of fish and few and species-poor wild terrestrial fauna—is found at Ukunju Cave, also in Mafia, although this sample is very small (Crowther *et al.*, 2014). Within Zanzibar, Fukuchani and Unguja Ukuu provide an interesting contrast with the island's known cave sites: the MIA and arguably 'Neolithic' Machaga Cave (Chami, 2001) and the MIA-LIA components at Kuumbi Cave (Prendergast *et al.*, 2016). At these sites, the paucity of marine resources and domesticates aligns them more closely with two sites of the southern Kenyan hinterland, Chombo and Mteza (Helm, 2000); these sites are also notable for their higher species richness, indicating that occupants had access to a wider

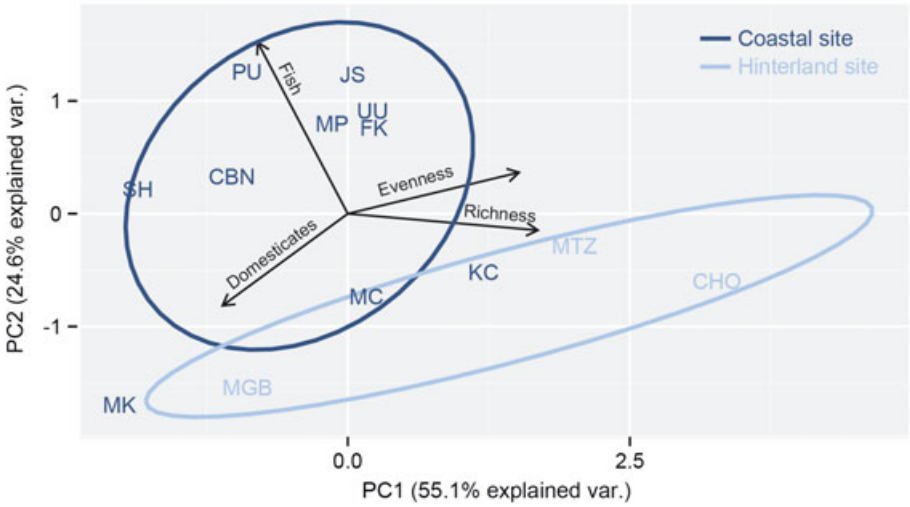

Figure 6. Principal component analysis of 13 sites with EIA (n = 1; JS) or MIA (n = 12) deposits and published, quantitative faunal data, separated by coastal or hinterland location. Site codes: CBN, Chibuene; CHO, Chombo; FK, Fukuchani; JS, Juani Primary School; KC, Kuumbi Cave; MC, Machaga Cave; MGB, Mgombani; MK, Mtwambe Mkuu; MP, Mpiji; MTZ, Mteza; PU, Ukunju Cave; SH, Shanga; UU, Unguja Ukuu. Variables: fish as % total vertebrate NISP; domesticates as % total tetrapod NISP, excluding marine animals, microfauna and categories for which wild or domestic status could not be ascertained; richness (NTAXA) and evenness (1/D) of the wild terrestrial faunal assemblage. See Table S10 for references and data. [Colour figure can be viewed at wileyonlinelibrary.com]

variety of terrestrial fauna than those on the islands. A neighbouring Kenyan hinterland site, Mgombani, differs from the other hinterland sites mainly in its abundance of domesticates, a trend also seen at Shanga in the Lamu archipelago (Horton, 1996), Mtwambe Mkuu on Pemba (Mudida & Horton, in press) and Chibuene in Mozambique (Badenhorst *et al.*, 2011). In summary, there is no single picture of early Swahili coast foodways: Coastal sites, logically, demonstrate a clear reliance on marine resources, but beyond this, variation in livestock keeping and hunting strategies may have had much to do with the sites' immediate environments and the choices made by the occupants.

Marine exploitation strategies

Fish bone assemblages from both Fukuchani and Unguja Ukuu represent a diverse set of fishing strategies in near-shore habitats, particularly not only around coral reefs but also in estuarine areas. The taxa identified at both sites—such as emperor fish, groupers, parrotfish and jacks—continue to be caught today with a variety of methods, including basket traps, hand lines and nets (Samoilys *et al.*, 2011). High numbers of reef-associated fish species attest to the importance of the island's fringing reefs as a source of food. A regional comparison of aquatic habitat exploitation demonstrated that coral reefs supplied the majority of fish consumed in past settlements on the offshore islands of Pemba and Zanzibar, whereas estuary fish were more abundant at Shanga and other near-shore or mainland settlements, reflecting the accessibility of aquatic resources around these sites (Quintana Morales, 2013; Quintana Morales & Horton, 2014). The data presented here are consistent with this pattern of adaptability to the local environment.

Although Unguja Ukuu and Fukuchani share similar spectra of fish taxa, there are some key differences between them. Fish are proportionally more important at Unguja Ukuu, and there is a significant component of large, fast-swimming fish at Unguja Ukuu not visible at Fukuchani. The Unguja Ukuu assemblage has some of the earliest examples on the Swahili coast both of tuna specimens and of cartilaginous fish (Chondrichthyes), which may belong to shark, dating to prior to c. 800 CE. Their presence could indicate the use of technologies capable of catching larger, fast-moving predators; long lines, trolling lines and gill nets are commonly used offshore today for this purpose (Samoilys *et al.*, 2011). However, these are minor components of the assemblage (<2% NISP), and it is more likely that these were opportunistic catches associated with fishing practises closer to the reef, such as those used for catching jacks, another group of fast-swimming predators that is more prominent at Unguja Ukuu. Data from coastal sites with long chronologies, like Shanga (Horton, 1996) and Chibuene (Badenhorst *et al.*, 2011), as well as diachronic comparisons at a

regional scale (Fleisher *et al.*, 2015; Quintana Morales, 2013), point to a substantial increase in outer reef/offshore fishing in the early second millennium CE. This new fishing strategy occurs in the context of increasing social stratification and intensifying overseas trade. The need for more expensive equipment and larger crews to target offshore fish could be related to a shifting social dynamic among fishers, in which a wealthier sponsor owns the boat and equipment and shares a portion of the catch with the fishing crew.

As noted earlier, abundance of emperor fish increases over time at Unguja Ukuu. Mudida & Horton (in press) describe a similar pattern of smaller quantities of emperor fish at earlier period sites in Zanzibar and Pemba, as well as in earlier levels at Shanga. They posit that increasing numbers of emperor fish could signify an increase in net fishing. It is difficult to prove this, given that emperor fish can be caught using a variety of methods, including nets, traps and lines. In our assemblage, we note the later appearance of certain species that are primarily caught with nets: halfbeaks (Hemiramphidae), moonies (Monodactylidae) and boxfish (Ostraciidae) (Samoilys *et al.*, 2011). A slight decrease in mean size of *Lethrinus* spp. individuals could be linked to an increase in fishing pressure. These patterns lend support to Mudida & Horton's (in press) hypothesis, but the wide range of emperor sizes and the overall diverse array of families continue to represent a mixed set of fishing strategies. Our data add to an emerging regional picture in which first millennium CE fishing strategies varied more across space than over time.

Animals and the Indian Ocean interaction sphere

The fauna from Fukuchani and Unguja Ukuu demonstrate that along with trade goods such as glass beads and exotic ceramics (Horton, in press; Juma, 1996; Juma, 2004), Asian animals were also brought to Zanzibar via maritime exchanges, as food items (chicken) and commensal stowaways (black rat). These taxa were identified at both sites but in greater abundance (and in the case of chicken, with greater certainty) at Unguja Ukuu. No house mouse was identified, despite recovery of similarly small bones such as those of musk shrew (*Crocidura* sp.). The domestic cats recovered at this site, while having origins in north-eastern Africa and south-western Asia (Ottoni *et al.*, in press), also likely arrived via Indian Ocean trading vessels, where they would have acted as pest control.

Based on the above-described Bayesian chronology (Crowther *et al.*, 2016b), chicken arrived at Unguja Ukuu by the seventh to eighth centuries CE. The possible chicken at Fukuchani dates to the same range. These chronologies coincide with those of Shanga on the coast and Chombo and Mgombani in the coastal hinterland in Kenya and of Chibuene in coastal Mozambique, all sites reporting early chicken remains (Badenhorst *et al.*, 2011; Helm, 2000; Mudida & Horton, 1996). For black rat, three direct dates were obtained at Unguja Ukuu from bones confirmed via ZooMS (Prendergast *et al.*, unpublished data): Two calibrate to the sixth to seventh centuries CE, another to the fifth to sixth centuries CE; however, these are viewed cautiously in light of isotopic analyses showing a marine-influenced diet for Unguja Ukuu rodents (Crowther *et al.*, unpublished data). Conservatively, we suggest that black rat arrives at both Unguja Ukuu and Fukuchani by the seventh to eighth centuries CE, based on associated dates. These findings, along with three specimens reported at Shanga (Mudida & Horton, 1996) and four at Chombo (Helm, 2000), are the region's earliest.

More speculatively, we might link the sea turtle remains, relatively abundant at Unguja Ukuu, to the tortoiseshell trade described in the *Periplus of the Erythrean Sea* (Casson, 1989), a first-century CE Greek document describing trade along the coast of 'Azania' (eastern Africa). Tortoiseshell is obtained from scutes after they are separated from the carapace, and it is unclear if this process would leave discernable traces. Hawksbill turtles (*Eretmochelys imbricata*) are strongly preferred for tortoiseshell exploitation in recent times, although green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles are sometimes used (O'Connor, 1987). It is thus interesting that despite local availability of *E. imbricata*, only *C. mydas* have been previously identified at Fukuchani and Unguja Ukuu (Table S6). In our study, given limited reference materials for *E. imbricata* and *C. caretta*, we did not attempt to differentiate among taxa. The high cut mark rates, on both limb and axial remains, do suggest exploitation for meat, possibly in addition to secondary (traded?) products such as oil, leather or tortoiseshell, which cannot be inferred on present evidence.

Conclusions

The faunal data from Fukuchani and Unguja Ukuu contribute to a growing body of data on past eastern African coastal livelihoods (Crowther *et al.*, in press). These data suggest that fishing and foraging strategies remained important throughout the first millennium CE. A variety of fishing strategies were concentrated

around coral reefs in near-shore aquatic environments, with no substantial evidence for the exploitation of fast-swimming predatory fish beyond the reefs, a strategy that is more apparent in the region's second millennium CE settlements (Fleisher *et al.*, 2015). The forests and coral rag thickets of Zanzibar provided wild game for the occupants of Fukuchani and, to a lesser extent, Unguja Ukuu, where a caprine-based domestic economy also flourished. Procurement of wild resources through trapping or netting likely involved a degree of community cooperation, and a metapodial bone bundle at Fukuchani speaks to the social significance of the wild animal realm. The remaining question is the relationships that existed among people occupying these two sites, as well as the broadly contemporaneous occupations at Machaga and Kuumbi caves (Chami, 2001; Prendergast *et al.*, 2016), where marine and domestic foods are rare to absent. Although all sites share some material culture, particularly TT/TIW ceramics, their occupants clearly had differing subsistence priorities.

Despite abundant material evidence for trade, particularly at Unguja Ukuu, Asian taxa are relatively uncommon at this site (especially in the earliest phase), and even more so at Fukuchani, despite concerted efforts to recover microfauna and identify non-native taxa. This fits with a pattern seen throughout the Swahili coast: that the introduction of Asian taxa was both later than previously suggested and quite gradual (Prendergast *et al.*, unpublished data). The successful exploitation of rich marine resources, and of local wild and domestic animals, may have left little need or desire for the incorporation of new fauna such as domestic chicken. Furthermore, the rarity of large, densely settled communities—Unguja Ukuu and Shanga being exceptional—may have thwarted the spread of ship-borne commensals such as black rat or house mouse. The overall emerging picture of MIA Swahili coast lifeways is one not of numerous 'urban' coastal trading ports, but rather of small-scale societies engaging in fishing, hunting or trapping and foraging as pursuits possibly equal or greater in importance to farming and herding. This finding forces us to consider more deeply the agents implicated in long-distance maritime trade and their economic and social identities.

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